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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/647,534	08/26/2003	Anthony Dip	240579US6YA	2715
22850	7590	05/02/2006	EXAMINER	
OBLON, SPIVAK, MCCLELLAND, MAIER & NEUSTADT, P.C. 1940 DUKE STREET ALEXANDRIA, VA 22314			MALDONADO, JULIO J	
			ART UNIT	PAPER NUMBER
			2823	

DATE MAILED: 05/02/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

17

Office Action Summary	Application No.	Applicant(s)	
	10/647,534	DIP ET AL.	
	Examiner	Art Unit	
	Julio J. Maldonado	2823	

– The MAILING DATE of this communication appears on the cover sheet with the correspondence address –

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 31 March 2006.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,2,4-8,10-12 and 17-23 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,2,4-8,10-12 and 17-23 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
 Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Objections

1. Claim 1 is objected because of the following informalities: where claim 1 recites, "...oxide layer of approximately 5Å-10Å...", change to -- oxide layer of approximately 5 Å -10Å--.
2. Claim 1 is also objected because of the following informalities: where claim 1 recites, "...contain free...", change to --contaminant free--.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 1, 5-8 and 10-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Thakur (U.S. 6,589,877 B1) in view of Wolf et al. (Silicon Processing for the VLSI Era, Volume 1: Process Technology).

In reference to claims 1, 5-8, 10, 11, Thakur (Fig.1) teaches a method of cleaning the surface of a substrate comprising silicon including the steps of growing a first layer of silicon oxide by thermal oxidation on the surface of the substrate; first etching said first oxide layer; growing a second silicon oxide layer by thermal oxidation; etching said second oxide layer; and repeating said oxidation and etching steps as desired until removing contaminant or substrate surface damage, wherein said etching steps are performed using a dry etching process wherein said etchant is chlorine gas or hydrogen

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fluoride gas and wherein said etchant is dissociated to form radicals (Thakur, column 2, line 39 – column 5, line 58 and column 8, lines 10 – 20).

Thakur fails to teach using a plasma process to etch said oxide layer. However, Wolf et al. in a related etching process teach dissociating chlorine and hydrogen fluoride molecules in a plasma environment to form radicals (Wolf et al., page 544, second paragraph). It would have been within the scope of one of ordinary skill in the art to combine the teachings of Thakur and Wolf et al. to enable the etching step of Thakur to be performed according to the teachings of Wolf et al. because one of ordinary skill in the art at the time the invention was made would have been motivated to look to alternative suitable methods of performing the disclosed etching step of Thakur and art recognized suitability for an intended purpose has been recognized to be motivation to combine. MPEP 2144.07.

The combined teachings of Thakur and Wolf et al. fail to expressly teach monitoring said surface region of the substrate and repeatedly growing an additional ultra-thin oxide layer to consume additional defects and etching the additional oxide layer to remove the consumed additional defects based on said monitoring of said surface region. However, it is inherent that there has to be an inspection step to detect level of contaminants on a substrate in order to continue or stopping said growing and etching steps until all of the contaminant or substrate surface damage has been removed.

The combined teachings of Thakur and Wolf et al. teach a less preferred embodiment of the invention including an oxide thickness of 10Å (Thakur, column 4,

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lines 32 – 50), but fail to teach growing said oxide layers having thicknesses of between approximately 5 Å and 15 Å. Although not taught as a preferred embodiment, the combination of Thakur and Wolf et al. teach this embodiment nonetheless, and disclosed examples and preferred embodiments do not constitute a teaching away from a broader disclosure or nonpreferred embodiments. In re Susi, 169 USPQ 423 (CCPA 1971). "A known or obvious composition does not become patentable simply because it has been described as somewhat inferior to some other product for the same use." In re Gurley, 31 USPQ2d 1130, 1132 (Fed. Cir. 1994). A reference may be relied upon for all that it would have reasonably suggested to one having ordinary skill in the art, including nonpreferred embodiments. Merck & Co. v. Biocraft Laboratories, 874 F.2d 804, 10 USPQ2d 1843 (Fed. Cir.), cert. denied, 493 U.S. 975 (1989). Even a teaching away from a claimed invention does not render the invention patentable. See Celeritas Technologies Ltd. v. Rockwell International Corp., 150 F.3d 1354, 1361, 47 USPQ2d 1516, 1522-23 (Fed. Cir. 1998), where the court held that the prior art anticipated the claims even though it taught away from the claimed invention. "The fact that a modem with a single carrier data signal is shown to be less than optimal does not vitiate the fact that it is disclosed." To further clarify, a prior art opinion that a claimed invention is not preferred for a particular limited purpose, does not preclude utility of the invention for that or another purpose, or even preferability of the invention for another purpose. Furthermore, in the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art" a prima facie case of obviousness exists. MPEP 2144.05. Therefore, it would have been obvious to one of ordinary skill in the art at the time the

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invention was made to use the thickness disclosed in the combined teachings of Thakur et al. to arrive at the claimed invention.

Still, the combined teachings of Thakur and Wolf et al. fail to expressly teach wherein repeatedly growing an oxide film to provide a substantially contaminant free substrate surface. However, the combination of Thakur and Wolf et al. teach that said cleaning is open to any number of oxidation and cleaning steps as required (Thakur, column 8, lines 10 – 20). Therefore, the combined teachings of Thakur and Wolf et al. are open to perform any number of cleaning steps to obtain a substantially contaminant-free substrate surface.

In reference to claim 12, the combined teachings of Thakur and Wolf et al. teach processing a plurality of substrates including said substrate, wherein each of said growing steps and each of said etching steps is performed on each of said plurality of substrates (Wolf et al., pages 230 – 234, and 568 – 574).

5. Claim 2 is rejected under 35 U.S.C. 103(a) as being unpatentable over Thakur (U.S. 6,589,877 B1) in view of Wolf et al. (Silicon Processing for the VLSI Era, Volume 1: Process Technology) as applied to claims 1, 5-8 and 10-12 above, and further in view of Pai et al. (U.S. 6,764,967 B2)

The combined teachings of Thakur and Wolf et al. teach forming an oxide to a thickness of 10Å (Thakur, column 4, lines 32 – 50), but fail to teach forming an oxide having a thickness approximately 5Å. However, Pai et al. teach a method of forming sacrificial oxides applied to substrate surface smoothing and other semiconductor fabrication processes, including growing an oxide layer to a thickness of between 5Å-

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15Å; removing said oxide layer; and repeating said oxide layer growing and removal (Pai et al., column 3, lines 39 – 61, and column 5, lines 24 – 61). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of Thakur, Wolf et al. and Pai et al. to enable growing an oxide layer in the Thakur and Wolf et al. according to the teachings of Pai et al. for the further advantage of obtaining a semiconductor substrate surface with improved electrical properties (Pai et al. column 5, lines 24 – 61) at a low thermal budget (Pai et al., column 2, lines 54 – 57).

6. Claims 4 and 17-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Thakur (U.S. 6,589,877 B1) in view of Wolf et al. (Silicon Processing for the VLSI Era, Volume 1: Process Technology) as applied to claims 1, 5-8 and 10-12 above, and further in view of Park et al. (A study on modified silicon surface after $\text{CHF}_3\text{C}/\text{C}_2\text{F}_6$ reactive ion etching).

The combined teachings of Thakur and Wolf et al. substantially teach all aspects of the invention but fail to disclose wherein said monitoring comprises using high-resolution transmission electron microscopy (HRTEM) data. However, Park et al. teach a monitoring method to detect level of contaminants on a substrate, wherein said monitoring includes HRTEM (Abstract). It would have been within the scope of one of ordinary skill in the art to combine the teachings of Thakur and Wolf et al. with Park et al. to enable monitoring the reduction of contaminants in the substrate of the combination of Thakur and Wolf et al. according to the teachings of Park et al. because one of ordinary skill in the art at the time the invention was made would have been

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motivated to look to alternative suitable methods of monitoring the substrate of Thakur and Wolf et al. and art recognized suitability for an intended purpose has been recognized to be motivation to combine. MPEP 2144.07.

In reference to claims 17-20, the combined teachings of Thakur, Wolf et al. and Park et al. inherently teach wherein said monitoring includes imaging the surface of the substrate after removal of one of said ultra-thin oxide layers using HRTEM data. Further support can be found in Wolf et al. (Semiconductor Processing for the VLSI Era, Volume 1: Process technology, pages 586, 587 and 597-599) and Herbots et al. (Figs.6A-6B and column 19, lines 15 – 40) and furthermore, since the same monitoring is used, the same data results would be obtained.

7. Claims 21-23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Thakur (U.S. 6,589,877 B1) in view of Wolf et al. (Silicon Processing for the VLSI Era, Volume 1: Process Technology) and Maydan et al. (2004/0121605 A1).

The combined teachings of Thakur and Wolf et al. substantially teach all aspects of the invention but fail to teach wherein the semiconductor substrate comprises silicon germanium. However, Maydan et al. teach a method of cleaning substrates including forming an oxide layer on a surface of a substrate, followed by removing said oxide, wherein said substrate comprises a material selected from the group including silicon and silicon germanium (Maydan et al., [0047]).

It would have been within the scope of one of ordinary skill in the art to combine the teachings of Thakur and Wolf et al. to enable using a substrate in the combination of Thakur and Wolf et al. according to the teachings of Maydan et al. because one of

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ordinary skill in the art at the time the invention was made would have been motivated to look to alternative suitable methods of using the disclosed substrate in Thakur and Wolf et al. and art recognized suitability for an intended purpose has been recognized to be motivation to combine. MPEP 2144.07.

Response to Arguments

8. Applicant's arguments filed 03/31/2006 have been fully considered but they are not persuasive.

Applicants argue, "...Thakur does not disclose forming an ultra thin oxide layer of 5-10Å...". In response to this argument, and as mentioned hereinabove, the combined teachings of Thakur and Wolf et al. teach a less preferred embodiment of the invention including an oxide thickness of at least 10Å (Thakur, column 4, lines 32 – 50), but fail to teach growing said oxide layers having thicknesses of between approximately 5 Å and 15 Å. Although not taught as a preferred embodiment, the combination of Thakur and Wolf et al. teach this embodiment nonetheless, and disclosed examples and preferred embodiments do not constitute a teaching away from a broader disclosure or nonpreferred embodiments. In re Susi, 169 USPQ 423 (CCPA 1971). "A known or obvious composition does not become patentable simply because it has been described as somewhat inferior to some other product for the same use." In re Gurley, 31 USPQ2d 1130, 1132 (Fed. Cir. 1994). A reference may be relied upon for all that it would have reasonably suggested to one having ordinary skill the art, including nonpreferred embodiments. Merck & Co. v. Biocraft Laboratories, 874 F.2d 804, 10 USPQ2d 1843 (Fed. Cir.), cert. denied, 493 U.S. 975 (1989). Even a teaching away

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from a claimed invention does not render the invention patentable. See *Celeritas Technologies Ltd. v. Rockwell International Corp.*, 150 F.3d 1354, 1361, 47 USPQ2d 1516, 1522-23 (Fed. Cir. 1998), where the court held that the prior art anticipated the claims even though it taught away from the claimed invention. "The fact that a modem with a single carrier data signal is shown to be less than optimal does not vitiate the fact that it is disclosed." To further clarify, a prior art opinion that a claimed invention is not preferred for a particular limited purpose, does not preclude utility of the invention for that or another purpose, or even preferability of the invention for another purpose. Furthermore, in the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art" a prima facie case of obviousness exists. MPEP 2144.05. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use the thickness disclosed in the combined teachings of Thakur et al. to arrive at the claimed invention.

Conclusion

9. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

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the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

10. Applicants are encouraged, where appropriate, to check Patent Application Information Retrieval (PAIR) (<http://portal.uspto.gov/external/portal/pair>) which provides applicants direct secure access to their own patent application status information, as well as to general patent information publicly available.

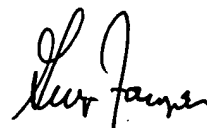
11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to examiner Julio J. Maldonado whose telephone number is (571) 272-1864. The examiner can normally be reached on Monday through Friday.

12. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Smith, can be reached on (571) 272-1907. The fax number for this group is 571-273-8300. Updates can be found at <http://www.uspto.gov/web/info/2800.htm>.



Julio J. Maldonado
April 22, 2006

Julio J. Maldonado
Patent Examiner
Art Unit 2823



George Fourson
Primary Examiner